WHAT IS CLAIMED

1. For use with a multiphase DC-DC voltage converter having a controller which generates a plurality of pulse width modulation (PWM) switching signals that switchably control operation of associated switching circuits containing first and second electronic power switching devices coupled between respective power supply terminals, and having phase nodes thereof coupled through respective inductors to regulated voltage output voltage terminals, a method of controlling generation of said PWM switching signals comprising the steps of:

(a) generating a master clock waveform;

(b) generating auxiliary voltage waveforms that effectively replicate ripple current waveforms in accordance with phase node voltages; and

(c) controlling the generation of said PWM switching signals in accordance with said master clock waveform and respective ones of said auxiliary voltage waveforms.

2. The method according to claim 1, wherein step (a) comprises coupling input and output voltages to a hysteretic comparator which controls the generation of said master clock signal.

3. The method according to claim 3, wherein step (b) comprises coupling phase node voltages to respective transconductance amplifier circuits, outputs of which

provide currents proportional to said phase node voltages, and supplying said currents to respective capacitors, to produce said auxiliary voltage waveforms.

4. The method according to claim 2, wherein said hysteretic comparator is operative to generate a first portion of said master clock waveform in response to a difference between said input and output voltages reaching a first prescribed threshold, and to generate a second portion of said master clock waveform in response to a difference between said output voltage and a reference voltage reaching a second prescribed threshold.

5. The method according to claim 4, wherein step (c) comprises controlling the generation of a first portion of a respective PWM switching signal in accordance with said first portion of said master clock waveform and controlling the generation of a second portion of said respective PWM switching signal in accordance with a respective one of said auxiliary voltage waveforms.

6. In a multiphase DC-DC voltage converter having a controller, which generates a plurality of pulse width modulation (PWM) switching signals that switchably control operation of respective switching circuits containing first and second electronic power switching devices coupled between respective power supply

terminals, and having phase nodes thereof coupled through inductors to multiphase regulated voltage output voltage terminals, the improvement comprising:

a master clock waveform generator;

an auxiliary voltage waveform generator which is operative to generate auxiliary voltage waveforms that effectively replicate ripple current waveforms through said inductors; and

a control circuit that is operative to control the generation of said PWM switching signals in accordance with said master clock waveform and respective ones of said auxiliary voltage waveforms.

7. The improvement according to claim 6, wherein said master clock generator comprises a hysteretic comparator that controls the generation of said master clock signal in accordance with input and output voltages of said DC-DC converter.

8. The improvement according to claim 7, wherein said auxiliary voltage waveform generator is operative to generate said auxiliary voltage waveforms to effectively replicate ripple current waveforms through said inductors by monitoring phase node voltages.

9. The improvement according to claim 8, wherein said control circuit includes transconductance amplifier circuits that are operative to monitor phase node voltages, with outputs of said transconductance

amplifier circuits supplying inductor voltage-representative currents proportional to phase node voltages to associated capacitors, to produce said auxiliary voltage waveforms.

10. The improvement according to claim 7, wherein said hysteretic comparator is operative to generate a first portion of said master clock waveform in response to a difference between said input and output voltages reaching a first prescribed threshold, and to generate a second portion of said master clock waveform in response to a difference between said output voltage and a reference voltage reaching a second prescribed threshold.

11. The improvement according to claim 10, wherein said control circuit is operative to control generation of a first portion of a respective PWM switching signal in accordance with said first portion of said master clock waveform and to control the generation of a second portion of said respective PWM switching signal in accordance with a respective one of said auxiliary voltage waveforms.

12. A multiphase synthetic ripple voltage regulator for a multiphase DC-DC converter, said multiphase synthetic regulator generating a plurality of pulse width modulation (PWM) switching signals that switchably control operation of respective switching

circuits containing first and second electronic power switching devices coupled between respective power supply terminals, and having phase nodes thereof coupled through inductors to multiphase regulated voltage output voltage terminals, said multiphase synthetic ripple voltage regulator comprising:

a master ripple voltage generator which is operative to generate a master ripple voltage waveform in accordance with respective currents proportional to the difference between an output voltage of said regulator and one of an input voltage or ground;

a hysteretic comparator which is operative to generate a master clock waveform in accordance with prescribed relationships between said master ripple voltage waveform and upper and lower voltage thresholds; and

PWM latch circuits, states of which define durations of respective components of a multiphase synthesized ripple voltage, a respective PWM latch circuit being coupled to have a first state thereof initiated by a selected master clock signal, and a second state thereof defined by an associated phase voltage comparator that monitors a respective phase node voltage.

13. The multiphase synthetic ripple voltage regulator according to claim 12, further including auxiliary voltage waveform generators that are operative to generate auxiliary voltage waveforms that effectively

replicate ripple current waveforms through said inductors by monitoring respective phase node voltages, wherein an output of a respective auxiliary voltage waveform generator is coupled to a respective phase voltage comparator.

14. The multiphase synthetic ripple voltage regulator according to claim 13, wherein said master ripple voltage generator includes transconductance amplifier circuits that are operative to monitor phase node voltages, with outputs of said transconductance amplifier circuits supplying inductor voltage-representative currents proportional to the voltage across said inductors to associated capacitors, to produce said auxiliary voltage waveforms.

15. The multiphase synthetic ripple voltage regulator according to claim 12, wherein said hysteretic comparator is operative to generate a first portion of said master clock waveform in response to a difference between said input and output voltages reaching a first prescribed threshold, and to generate a second portion of said master clock waveform in response to a difference between said output voltage and a reference voltage reaching a second prescribed threshold.

16. The multiphase synthetic ripple voltage regulator according to claim 15, wherein said PWM latch circuits are to control generation of a first portion of

a respective PWM switching signal in accordance with said first portion of said master clock waveform and to control the generation of a second portion of said respective PWM switching signal in accordance with a respective one of said auxiliary voltage waveforms.

17. The multiphase synthetic ripple voltage regulator according to claim 12, wherein said master ripple voltage generator which is operative to generate a first portion of said master ripple voltage waveform in accordance a first current proportional to the difference between said input and output voltages of said regulator, and to generate a second portion of said master ripple voltage waveform in accordance with a second current proportional to the difference between ground and said output voltage.

18. A multiphase synthetic ripple voltage regulator for a multiphase DC-DC voltage converter, said multiphase synthetic voltage regulator generating a plurality of pulse width modulation (PWM) switching signals that switchably control operation of respective switching circuits containing first and second electronic power switching devices coupled between respective power supply terminals, and having phase nodes thereof coupled through inductors to multiphase regulated voltage output voltage terminals, said multiphase synthetic ripple voltage regulator comprising:

a master ripple voltage generator which is operative to generate a master ripple voltage waveform having a first waveform portion defined in accordance with a first current proportional to the difference between an input and output voltage of said regulator, and having a second waveform portion defined in accordance with a second current proportional to the difference between ground and said output voltage;

a hysteretic comparator which is operative to generate a master clock waveform in accordance with said first portion of said master ripple voltage waveform reaching an upper voltage threshold, and said second portion of said master ripple voltage reaching a lower voltage threshold;

a plurality of phase ripple voltage generators, a respective one of which is operative to generate a respective phase ripple voltage waveform defined in accordance with a current proportional to the difference between an associated phase node voltage and said output voltage of said regulator; and

a plurality of PWM latch circuits, states of which define durations of respective components of a multiphase synthesized ripple voltage, a respective PWM latch circuit being coupled to have a first state thereof initiated by a selected master clock signal, and a second state thereof defined by an associated phase voltage comparator that monitors a respective phase ripple voltage.

19. The multiphase synthetic ripple voltage regulator according to claim 18, further including a sequence circuit which is coupled to place a respective PWM latch circuit in said first state in accordance with a selected master clock waveform.

20. The multiphase synthetic ripple voltage regulator according to claim 19, wherein a respective phase voltage comparator is operative to initiate said second state of said respective PWM latch circuit in response to a difference between said phase voltage and said output voltage reaching said upper threshold voltage.

21. The multiphase synthetic ripple voltage regulator according to claim 18, wherein said lower threshold voltage corresponds to that produced by a hysteretic comparator.

22. The multiphase synthetic ripple voltage regulator according to claim 18, wherein said upper threshold voltage corresponds to the lower threshold voltage plus a voltage proportional to said output voltage.

23. The multiphase synthetic ripple voltage regulator according to claim 18, wherein said hysteretic comparator is operative to increase the frequency of said master clock waveform in response to a transient in

output load.